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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/090,103	02/27/2002	Zheng Yuan	A6381/T45600	4419
32588	7590	09/22/2004	EXAMINER	
APPLIED MATERIALS, INC. 2881 SCOTT BLVD. M/S 2061 SANTA CLARA, CA 95050			POMPEY, RON EVERETT	
			ART UNIT	PAPER NUMBER
			2812	

DATE MAILED: 09/22/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/090,103

Applicant(s)

YUAN ET AL.

Examiner

Ron E Pompey

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 July 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-27 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 23-27 is/are allowed.
- 6) ☒ Claim(s) 1-22 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by Horie (US 5,928,428).

Horie discloses the limitations of:

introducing tetraethylorthosilane (F4, fig. 2) into the processing chamber;

purging the tetraethylorthosilane (F5, fig. 2) from the processing chamber;

introducing ozone (F6, fig. 2) into the processing chamber after purging of the tetraethylorthosilane to form the thin silicon oxide layer; and

purging the ozone (F6, fig. 2) from the processing chamber (col. 5, Ins. 18 - 49).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 2-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Horie (US 5,928,428) in further view of Vassiliev et al. (US 6,180,490), Admitted prior art (APA) and Werner Gasser et al. ("Quasi-monolayer deposition of silicon dioxide").

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Horie does not disclose the claimed limitation(s) of:

repeating and reversing the limitations of claim1;

wherein the thin silicon oxide layer is formed over a silicon nitride mask and over a thermal oxide trench liner;

further comprising performing chemical vapor deposition of silicon oxide on top of the thin silicon oxide layer;

wherein the chemical vapor deposition of silicon oxide is performed by mixing tetraethylorthosilane and ozone in the processing chamber following purging of the ozone;

wherein the chemical vapor deposition of silicon oxide is performed in a different processing chamber;

wherein the silicon-containing precursor gas comprises SiCl_4 , $\text{Si}(\text{NCO})_4$ and $\text{CH}_3\text{OSi}(\text{NCO})_3$ and the oxidant comprises steam (H_2O), steam (H_2O) and hydrogen peroxide (H_2O_2) respectively and

wherein the purging process occurs by introduction of an inert gas.

However,

a. Vassiliev discloses the above claimed limitations regarding:

wherein the thin silicon oxide layer (11, fig. 7a) is formed over a silicon nitride mask and over a thermal oxide trench liner (13, fig. 7a); and performing chemical vapor deposition, by mixing tetraethylorthosilane and ozone (12, fig. 7a), of silicon oxide on top of the thin silicon oxide layer in column(s) 7, line(s) 63 - column(s) 8, line(s) 9.

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Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to combine Horie with Vassiliev, because the thermal oxide liner provides for better adhesion between the silicon and the TEOS layers filling a trench and the conventional tetraethylorthosilane and ozone provide good conformity in filling trenches.

b. Repeating and reversing the limitations of claim1:

The courts have held that the mere repeating or reversing of claimed steps has no patentable significance unless a new and unexpected result is produced (see *In re Harza*, 274 F.2d 669, 124 USPQ 378 (CCPA 1960) and *Ex parte Rubin*, 128 USPQ 440 (Bd. App. 1959)). Therefore, no consideration will be given to these limitations regarding the patentability of the invention, since applicant does not disclose any new and unexpected results due to the repeating or reversing of the limitations of claim 1. Also, the conditions of wherein the silicon containing precursor gas comprises SiCl_4 , $\text{Si}(\text{NCO})_4$ and $\text{CH}_3\text{OSi}(\text{NCO})_3$ and the oxidant comprises steam (H_2O), steam (H_2O) and hydrogen peroxide (H_2O_2) respectively are disclosed as conventional processes on page 7, lines 20-29 in applicants specification. Therefore one of ordinary skill would know to use these processing conditions to form an oxide.

c. Werner discloses the above claimed limitations regarding:

wherein each purging process occurs by introduction of an inert gas (Fig. 3, pg. 215).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to combine Werner with Horie, because the nitrogen cleaning

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between depositions ensures removal of molecules that could contribute to additional growth.

Allowable Subject Matter

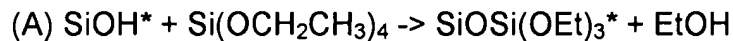
2. Claims 23-27 are allowed.
3. The following is a statement of reasons for the indication of allowable subject matter: the prior art of record, either singly or in combination, fails to disclose the limitations of:

wherein the forming of a layer comprises alternating (i) introducing to the chamber a first gas consisting of one of a silicon-containing precursor gas and an oxidant, (ii) purging the first gas from the chamber, (iii) introducing to the chamber a second gas consisting of the other of the silicon-containing precursor gas and the oxidant, (iv) purging the second gas from the chamber, and repeating steps (i) - (iv) until a desired thickness of the silicon oxide layer is achieved without filling a trench.

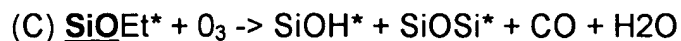
Response to Arguments

4. Applicant's arguments filed July 1, 2004, pertaining to claims 1-27, have been fully considered but they are not persuasive.
5. The applicant argues that the Prior Art does not disclose forming the thin silicon oxide layer until after ozone is provided in the chamber. However, because the same precursor, TEOS, is being supplied in the chamber with no other gases, as the claimed invention, the same result will occur in the process chamber. Also, on page 6 of applicant's remarks he discloses:

"Embodiments in accordance with the present invention relate to methods and apparatuses wherein a thin oxide film is formed as the result of successive introduction and purging of TEOS and ozone. ...is a thin layer of silicon oxide formed:



(B) Purge TEOS



(Emphasis added; paragraph [18]) "

Step (C) appears to show that some form of silicon oxide is formed before the ozone is supplied into the chamber. Therefore this would make applicant's argument incorrect that **no** silicon oxide is formed until after the ozone gas is introduced into the chamber.

Conclusion

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).


A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.


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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ron E Pompey whose telephone number is (571) 272-1680.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Niebling can be reached on (571) 272-1679. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


Ron Pompey
AU: 2812
September 20, 2004


John F. Niebling
Supervisory Patent Examiner
Technology Center 2800